

Foundations of Statistical Modeling II



Multinomial Processing Tree (MPT) Modeling: Basic Methods and Recent Advances, Block 2

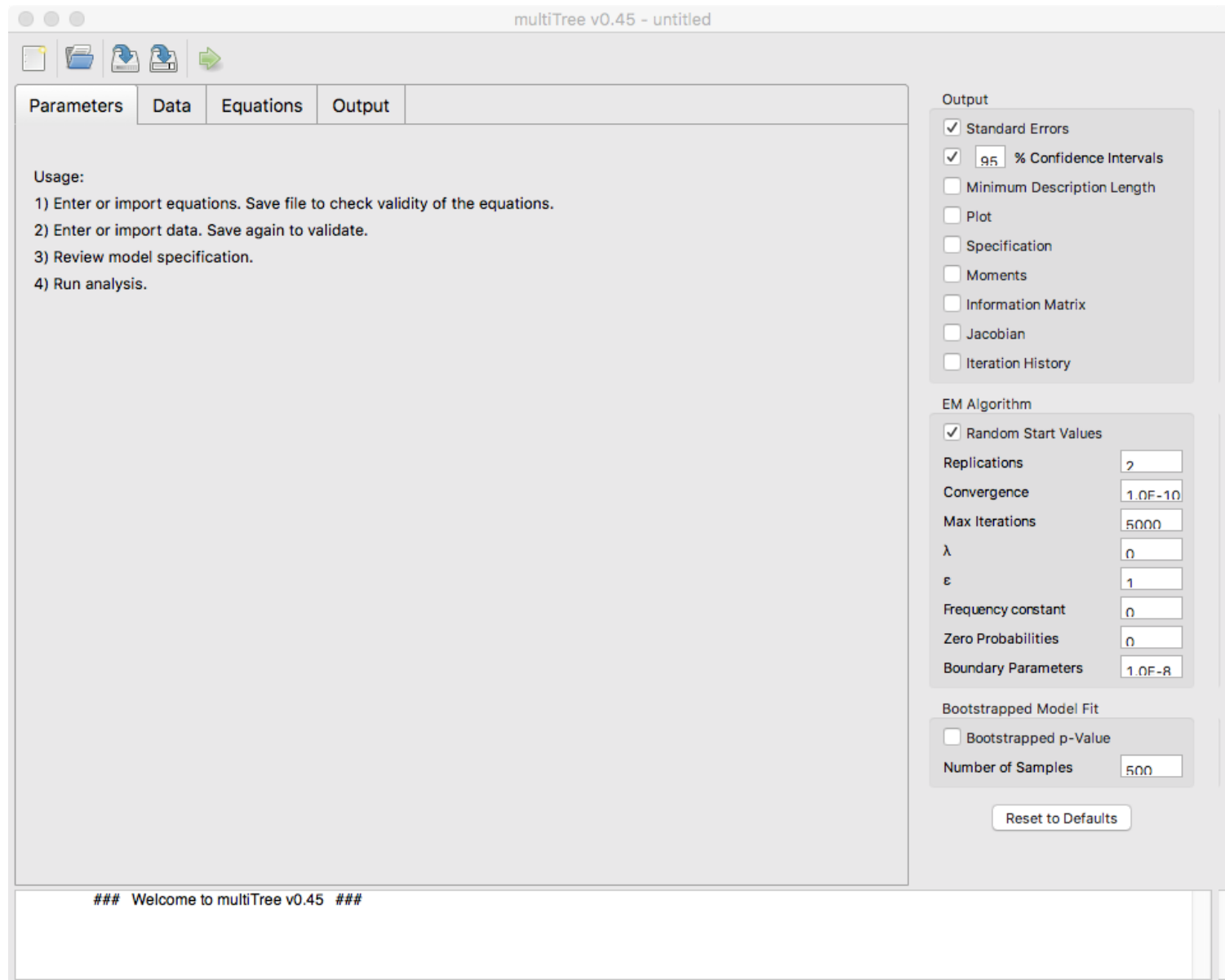
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2) Applications I

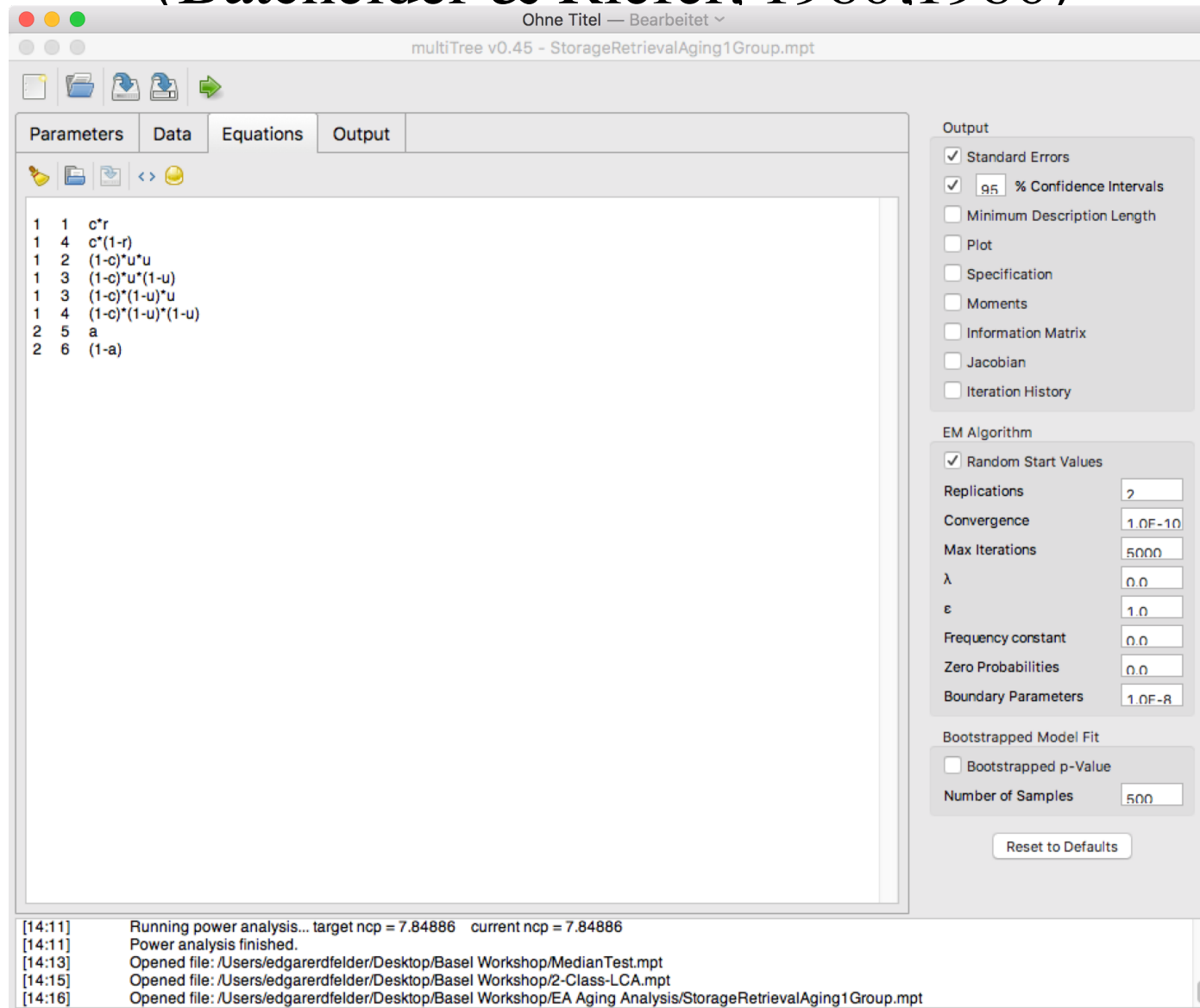
- 2.1) Introduction to multiTree
- 2.2) Practical exercises
- 2.3) Order constraints
- 2.4) Testing interactions

2.1) Introduction to multiTree

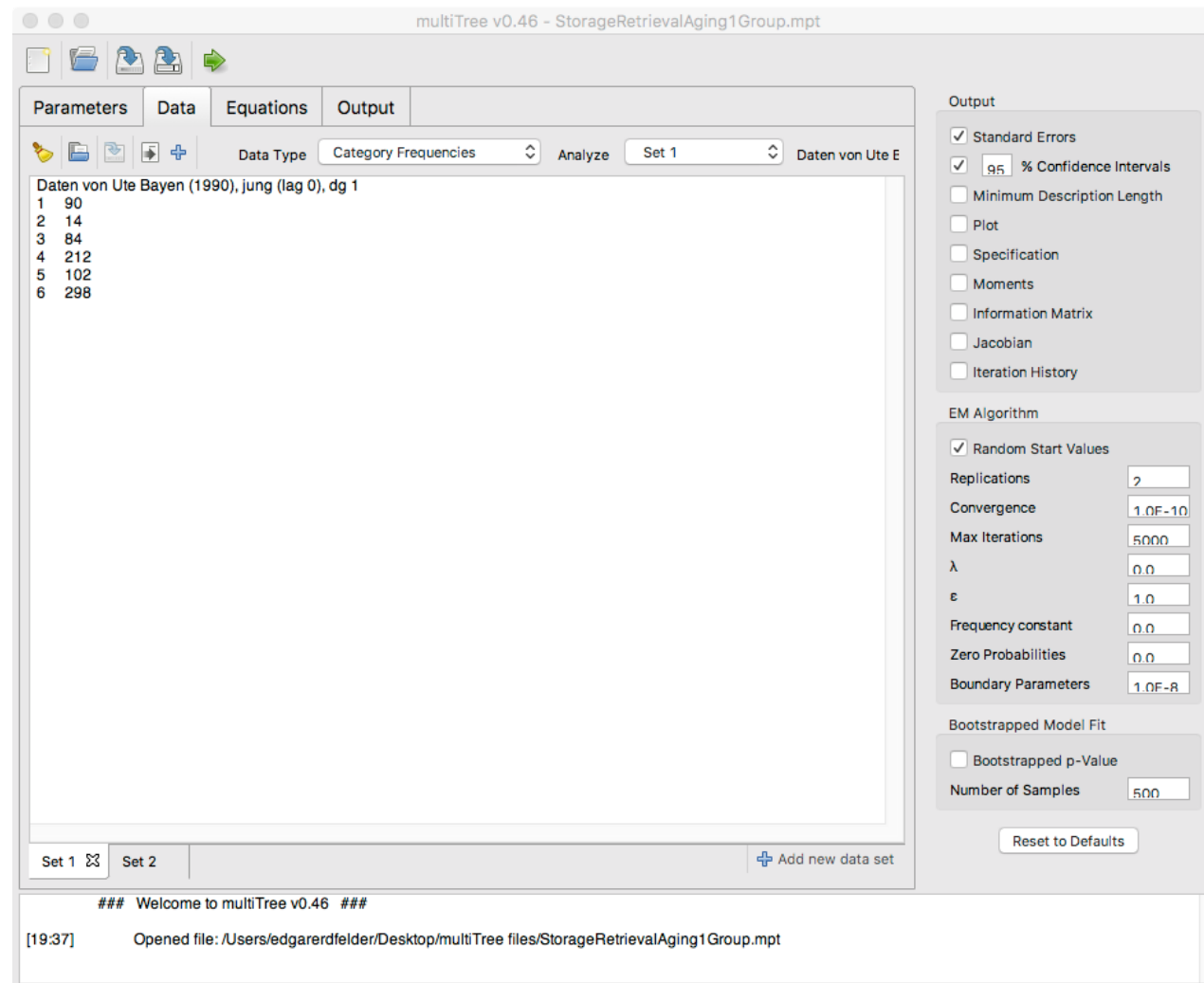


Storage-Retrieval Model

(Batchelder & Riefer, 1980, 1986)



Data



Model definition and analysis

The screenshot displays the multiTree v0.46 software interface. The title bar indicates the file path: multiTree v0.46 - StorageRetrievalAging1Group.mpt. The interface is divided into several sections:

- Parameters**: Contains a "Hierarchical Model Families" section with two checkboxes: "Define current model as new baseline model (needs to be estimated before it can serve as a baseline)." and "Compare current model against baseline model". Below this is a table for parameter specification:

Parameter	Value
a	= u
c	free
r	free
u	free

- Specification**: A table showing model specifications:

Specification	Value
Number of trees	2
Number of categories	6
Number of free categories	4
Number of parameters	4
Number of constrained parameters	1
Degrees of freedom	1

- Output**: A section with checkboxes for various output options: Standard Errors, % Confidence Intervals (set to .95), Minimum Description Length, Plot, Specification, Moments, Information Matrix, Jacobian, and Iteration History.
- EM Algorithm**: A section with checkboxes for Random Start Values and a table for algorithm parameters:

Parameter	Value
Replications	2
Convergence	1.0E-10
Max Iterations	5000
λ	0.0
ϵ	1.0
Frequency constant	0.0
Zero Probabilities	0.0
Boundary Parameters	1.0E-8

- Bootstrapped Model Fit**: A section with a checkbox for Bootstrapped p-Value and a table for the number of samples:

Parameter	Value
Number of Samples	500

At the bottom of the interface, there is a status bar with the text: "### Welcome to multiTree v0.46 ###" and a message: "[19:37] Opened file: /Users/edgarerdfelder/Desktop/multiTree files/StorageRetrievalAging1Group.mpt".

Output

The screenshot displays the multiTree v0.46 software interface. The main window is titled "multiTree v0.46 - StorageRetrievalAging1Group.mpt". It features a tabbed interface with "Parameters", "Data", "Equations", and "Output" tabs. The "Output" tab is active, showing the following information:

File: /Users/edgarerdfelder/Desktop/multiTree files/StorageRetrievalAging1Group.mpt
Data Set 1: Daten von Ute Bayen (1990), jung (lag 0), dg 1

Estimation proceeded normally.

Model Fit

PD^{lambda}=0.0 (df=1) = 0.00731 p = 0.93188

ln(likelihood) = -673.97963
AIC = 1353.95926
BIC = 1368.01310
Delta AIC = -1.99269
Delta BIC = -6.67731

Parameter Estimates, Standard Errors, and Confidence Intervals

Parameter	Estimate	Standard Error	Lower Bound	Upper Bound
a	u			
c	0.44813	(0.06124)	[0.32811 - 0.56816]	
r	0.50209	(0.07298)	[0.35905 - 0.64512]	
u	0.25431	(0.02021)	[0.21470 - 0.29392]	

On the right side, the "Output" panel shows options for "Standard Errors" (checked), "95 % Confidence Intervals" (checked), "Minimum Description Length", "Plot", "Specification", "Moments", "Information Matrix", "Jacobian", and "Iteration History". The "EM Algorithm" panel shows "Random Start Values" (checked), "Replications" (2), "Convergence" (1.0E-10), "Max Iterations" (5000), and various other parameters. The "Bootstrapped Model Fit" panel shows "Bootstrapped p-Value" (unchecked) and "Number of Samples" (500). A "Reset to Defaults" button is at the bottom.

At the bottom of the main window, a log shows the following messages:

```
[19:48] Estimation #2  
[19:48] Estimation #3: Iteration 100...converged  
[19:48] Estimation #2: Iteration 105...converged  
[19:48] Estimation #1: Iteration 105...converged  
[19:48] Analysis finished
```

2.2) Practical exercises

- Estimate the storage-retrieval model for young and old participants jointly
- Does c differ significantly between age groups?
- Does r differ significantly between age groups?

2.3 Order constraints

- To impose the order constraint
 $c(\text{old}) \leq c(\text{young})$,
set
 $c(\text{old}) = x_c \cdot c(\text{young})$

2.4 Testing interactions

- To test the H_0 that the decline with aging is the same in *storage* c and *retrieval* r (i.e., no interaction with aging)

set

$$c(\text{old}) = x_c \cdot c(\text{young})$$

$$r(\text{old}) = x_r \cdot r(\text{young})$$

and test the equality constraint

$$H_0: x_c = x_r$$